

## CLAIMS

I/We Claim:

1. A voltage-controlled oscillator, comprising:
- a plurality of cascaded voltage-controlled oscillator cells, each voltage-controlled oscillator cell having a plurality of outputs, each voltage-controlled oscillator cell further comprising:
    - a pair of source coupled nMOS transconductor transistors;
    - a bias transistor coupled between a ground voltage and the source coupled nMOS transconductor transistors;
    - a pair of varactors coupled to a control voltage and the pair of source coupled nMOS transconductor transistors;
    - a pair of drain coupled pMOS transistors, the pair of drain coupled pMOS transistors coupled between a supply voltage and the pair of source coupled nMOS transconductor transistors; and
    - a common mode feedback circuit, the common mode feedback circuit further comprising:
      - a resistive network, the resistive network having a plurality of coupled resistors, each resistor coupled to one of the plurality of outputs of each voltage-controlled oscillator cell; and
      - an op-amp, the op-amp connected to the resistive network, the op-amp generating an output voltage corresponding to a variance between the voltage-controlled oscillator cells and a reference voltage on a reference voltage output, the reference voltage output being coupled to each bias transistor in the plurality of cascaded voltage-controlled oscillator cells.

2. The voltage-controlled oscillator of claim 1, wherein the pair of varactors are MOS voltage-controlled capacitors.

3. The voltage-controlled oscillator of claim 1, wherein the pair of varactors are p-n junction voltage-controlled capacitors.

4. The voltage-controlled oscillator of claim 1, wherein the control voltage is provided at least in part by a charge pump circuit.

5. The voltage-controlled oscillator of claim 1, wherein the control voltage is provided at least in part by a loop filter circuit.

6. The voltage-controlled oscillator of claim 1, wherein the control voltage is provided at least in part by a phase frequency detector circuit.

7. The voltage-controlled oscillator of claim 1, wherein the control voltage is provided at least in part by a charge pump coupled with a loop filter circuit coupled with a phase frequency detector circuit.

8. The voltage-controlled oscillator of claim 1, wherein the plurality of cascaded voltage-controlled oscillator cells consists of three cascaded voltage-controlled oscillator cells.

9. A voltage-controlled oscillator, comprising:  
a plurality of cascaded voltage-controlled oscillator cells, each voltage-controlled oscillator cell having at least one output, each voltage-controlled oscillator cell further comprising:  
a first pair of coupled transistors;  
a bias transistor coupled to the first pair of coupled transistors;

at least one voltage-controlled capacitor coupled to a control voltage  
and to the first pair of coupled transistors; and  
a second pair of coupled transistors, the second pair of coupled  
transistors further coupled to the first pair of coupled  
transistors.

10. The voltage-controlled oscillator of claim 9, further comprising:  
a common mode feedback circuit, the common mode feedback circuit  
further comprising:  
a resistive network, the resistive network having a plurality of  
coupled resistors, each resistor coupled to the at least one  
output of each voltage-controlled oscillator cell; and  
an op-amp, the op-amp connected to the resistive network, the op-  
amp generating an output voltage corresponding to a  
variance between the voltage-controlled oscillator cells and a  
reference voltage on a reference voltage output, the  
reference voltage output being coupled to each bias  
transistor in the plurality of cascaded voltage-controlled  
oscillator cells.

- 103 11. The voltage-controlled oscillator of claim 9, wherein the pair of  
varactors are MOS voltage-controlled capacitors.

- 103 12. The voltage-controlled oscillator of claim 9, wherein the pair of  
varactors are p-n junction voltage-controlled capacitors.

- ✓ 13. The voltage-controlled oscillator of claim 9, wherein the control  
voltage is provided at least in part by a charge pump circuit.

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✓ 14. The voltage-controlled oscillator of claim 9, wherein the control voltage is provided at least in part by a loop filter circuit.

✓ 15. The voltage-controlled oscillator of claim 9, wherein the control voltage is provided at least in part by a phase frequency detector circuit.

✓ 16. The voltage-controlled oscillator of claim 9, wherein the control voltage is provided at least in part by a charge pump coupled with a loop filter circuit coupled with a phase frequency detector circuit.

0 17. The voltage-controlled oscillator of claim 9, wherein the plurality of cascaded voltage-controlled oscillator cells consists of three cascaded voltage-controlled oscillator cells.

✓ 18. A method for reducing jitter in a voltage-controlled oscillator having a plurality of voltage-controlled oscillator cells, each voltage-controlled oscillator cell having a plurality of output voltage waveforms, the method comprising:

combining each of the output voltage waveforms to produce a combined waveform;

deriving a common mode feedback waveform from the combined waveform, and from a reference waveform; and

transmitting the common mode feedback waveform to each of the plurality of voltage-controlled oscillator cells.

✓ 19. A voltage-controlled oscillator having a plurality of voltage-controlled oscillator cells, each voltage-controlled oscillator cell having a plurality of output voltage waveforms, comprising:

combining means for combining each of the output voltage waveforms to produce a combined voltage;

deriving means for deriving a common mode feedback voltage from the combined voltage and a reference voltage; and  
transmitting means for transmitting the common mode feedback voltage to each of the plurality of voltage-controlled oscillator cells.

102 101 100 20. A wireless communications device, comprising:  
a voltage-controlled oscillator having a plurality of cascaded voltage-controlled oscillator cells, each voltage-controlled oscillator cell having at least one output, each voltage-controlled oscillator cell further comprising:  
a first pair of coupled transistors;  
a bias transistor coupled to the first pair of coupled transistors;  
at least one voltage-controlled capacitor coupled to a control voltage and the first pair of coupled transistors; and  
a second pair of coupled transistors, the second pair of coupled transistors further coupled to the first pair of coupled transistors.

21. The voltage-controlled oscillator of claim 20, further comprising:  
a common mode feedback circuit, the common mode feedback circuit further comprising:  
a resistive network, the resistive network having a plurality of coupled resistors, each resistor coupled to the at least one output of each voltage-controlled oscillator cell; and  
an op-amp, the op-amp connected to the resistive network, the op-amp generating an output voltage corresponding to a variance between the voltage-controlled oscillator cells and a reference voltage on a reference voltage output, the reference voltage output being coupled to each bias

transistor in the plurality of cascaded voltage-controlled oscillator cells.

103 22. The voltage-controlled oscillator of claim 20, wherein the pair of varactors are MOS voltage-controlled capacitors.

103 23. The voltage-controlled oscillator of claim 20, wherein the pair of varactors are p-n junction voltage-controlled capacitors.

24. The voltage-controlled oscillator of claim 20, wherein the control voltage is provided at least in part by a charge pump circuit.

102 25. The voltage-controlled oscillator of claim 20, wherein the control voltage is provided at least in part by a loop filter circuit.

26. The voltage-controlled oscillator of claim 20, wherein the control voltage is provided at least in part by a phase frequency detector circuit.

27. The voltage-controlled oscillator of claim 20, wherein the control voltage is provided at least in part by a charge pump coupled with a loop filter circuit coupled with a phase frequency detector circuit.

0 28. The voltage-controlled oscillator of claim 20, wherein the plurality of cascaded voltage-controlled oscillator cells consists of three cascaded voltage-controlled oscillator cells.

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29. A high-speed serial data link semiconductor chip, comprising:  
a voltage-controlled oscillator having a plurality of cascaded voltage-controlled oscillator cells, each voltage-controlled oscillator cell

having at least one output, each voltage-controlled oscillator cell further comprising:

a first pair of coupled transistors;

a bias transistor coupled to the first pair of coupled transistors;

at least one voltage-controlled capacitor coupled to a control voltage and the first pair of coupled transistors; and

a second pair of coupled transistors, the second pair of coupled transistors further coupled to the first pair of coupled transistors.

30. The semiconductor chip of claim 29, further comprising:
- a common mode feedback circuit, the common mode feedback circuit further comprising:
- a resistive network, the resistive network having a plurality of coupled resistors, each resistor coupled to the at least one output of each voltage-controlled oscillator cell; and
- an op-amp, the op-amp connected to the resistive network, the op-amp generating an output voltage corresponding to a variance between the voltage-controlled oscillator cells and a reference voltage on a reference voltage output, the reference voltage output being coupled to each bias transistor in the plurality of cascaded voltage-controlled oscillator cells.

31. The semiconductor chip of claim 29, wherein the pair of varactors are MOS voltage-controlled capacitors.

32. The semiconductor chip of claim 29, wherein the pair of varactors are p-n junction voltage-controlled capacitors.

33. The semiconductor chip of claim 29, wherein the control voltage is provided at least in part by a charge pump circuit.

102 34. The semiconductor chip of claim 29, wherein the control voltage is provided at least in part by a loop filter circuit.

35. The semiconductor chip of claim 29, wherein the control voltage is provided at least in part by a phase frequency detector circuit.

36. The semiconductor chip of claim 29, wherein the control voltage is provided at least in part by a charge pump coupled with a loop filter circuit coupled with a phase frequency detector circuit.

0 37. The semiconductor chip of claim 29, wherein the plurality of cascaded voltage-controlled oscillator cells consists of three cascaded voltage-controlled oscillator cells.